FORTE
TESTING AND CONSULTANTS CO., LTD.

HOKLAS 191
TEST

FIRE RESISTANCE TEST REPORT

DOUBLE LEAF COMPOSITE TIMBER DOOR with GLAZED ELEMENTS AND SIDE & OVERHEAD PANELS

in accordance with ***BS EN 1634-1: 2008***

Test Sponsor: **Garish Crown Fire Engineering & Consultancy**
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Report Number: IT 13-247

Date of Issue: 2014-03-24

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HOKLAS Approved Signatory:

Ir. Dr Chan Yuk Kit

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1. Scope of Test

This report is a record of a fire resistance test conducted by Forte Testing and Consultants Co., Ltd, in conformity with requirements in *BS EN 1634-1: 2008 "Fire resistance and smoke control tests for door, shutter and openable window assemblies and elements of building hardware Part 1: Fire resistance tests for doors, shutters and openable windows"* and particular requirements in *BS EN 1363-1: 1999 "Fire resistance tests – Part 1: General requirements"*.

The test subject was an double leaf composite timber door with glazed elements, glazed side panel and overhead panel. The specimen was manufactured and supplied for test by Leung's Wooden Company Limited, the Sponsor.

The specimen achieved the following fire resistance:

INTEGRITY (E)			**INSULATION (I_1)**		
	Sustained Flaming	49 Minutes	Door Leaves & Framework	Average Temp. Rise	49 Minutes
				Max. Temp. Rise (I_1)	49 Minutes
	Gap Gauge	49 Minutes	Glazed Elements	Average Temp. Rise	49 Minutes
				Max. Temp. Rise	49 Minutes
	Cotton Pad	49 Minutes	Overhead Panel	Average Temp. Rise	49 Minutes
				Max. Temp. Rise (I_1)	49 Minutes
			Glazed Side Panel	Average Temp. Rise	49 Minutes
				Max. Temp. Rise (I_1)	49 Minutes

2. Test Information

Test Laboratory:	FORTE Testing and Consultants Company Limited
Test Location:	West Side of Huan Xiang Shan, Xin Yu Road, Shajin, Baoan District, Shenzhen, Guangdong Province, China.
Test Sponsors:	Leung's Wooden Company Limited Garish Crown Fire Engineering & Consultancy
ID no. of the specimen:	QT 13-057A
Date Received:	2013-04-23
Test Number:	QT 13-057 *A total of two sets of report (Report no. IT13-053 and IT13-247) are issued on this test
Date Tested:	2013-04-26 **Start Time:** 16:17
Approved Test Operator from FORTE:	Ms. Cheng San Mei, Sammi
Witness of the Test:	Mr. C.K. Leung – Official Delegate of the Sponsor

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3. Construction Details of Specimen

3.1 Specimen Description

3.1.1 Framework

The timber framework was overall sized 2764 mm (width) x 2961 mm (height). The sectional dimension of the perimeter framework was 50 mm (w) x 100 mm (t) with 20 mm single door stop rebate. The transom and mullion between door leaves and panel had a sectional dimension 70 mm (w) x 100 mm (t) with 20 mm single rebate on two sides.

The film ply-wood sub-frame was sized 100 mm (w) by 18 mm (t). The sub-frame was fixed onto the back of the framework by 10 x 112 mm screws at approximate 200 mm centre to centre.

The framework with sub-frame was fixed into the opening on the drywall partition system by 10 x 72 mm self-tapping screws. There were 8 numbers of fixings on each jamb and head.

Wooden architraves sized 45 mm (w) x 12 mm (t) were fixed over the framework and sub-frame on both sides by wood nails at approximate 250 mm centre to centre.

1 number of 20 mm (w) x 4 mm (t) intumescent seal and 1 number of 10 mm (w) x 4 mm (t) intumescent seal were fitted aside into groove on the jambs and head of door frame.

1 number of 30 mm (w) x 4 mm (t) intumescent seal was fitted aside into groove on the framework perimeter of the overhead panel.1 number of rebate corner smoke seal was adhered along the rebate corners of the framework.

The space between the supporting frame and the framework was fully filled with fire sealant.

3.1.2 Door Leaves

The specimen comprised of two composite timber door leaves. The active leaf sized 1100 mm (w) x 2338 mm (h) x 50 mm (t) and the inactive leaf sized 1200 mm (w) x 2338 mm (h) x 50 mm (t).

The main stiles and rails of the door leaf were made of 3 numbers of timber slabs sized 40 mm (w) x 38 mm (t). The slabs were fixed together by brackets and glue. The mid ails were made of wooden slab sized 45 mm (w) x 38 mm (t).

The core of the door leaves was filled with 38 mm (t) perlite board.

Both sides of the core were covered by a layer of 3 mm (t) fire board. The fire boards on both sides of door core were fixed together by ø4 x 25 mm wood screws at approximate 200 mm - 400 mm centre to centre onto the door core.

Both sides of the door leaves were finished with 3 mm (t) medium density fibreboard (MDF) facing. The facings were fixed onto the sub-facing by glue.

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The meeting edge was unequal single rebated type.

1 number of 10 mm (w) x 4 mm (t) intumescent seal with side plastic fins was fitted into groove on along meeting edge close to the rebate corner of the active leaf. The intumescent seal was not interrupted.

1 number of 20 mm (w) x 4 mm (t) intumescent seal was fitted into groove along meeting edge close to rebate corner of the inactive leaf. The width of intumescent seal was reduced at strike plate position.

1 number of rebate corner smoke seal was adhered along the meeting edge rebate corner on the inactive leaf. The smoke seal was not interrupted except being halved at the strike plate position.

The door lippings were made of wooden strips.

3.1.3 Glazed Elements

The specimen comprised of three glazed elements.

On the inactive leaf there were two glazed elements: the top glazed element was overall sized 775 mm (w) x 225 mm (h) and the second glazed element was overall sized 325 mm (w) x 325 mm (h). On the inactive leaf there were one glazed element overall sized 275 mm (w) x 1625 mm (h). The positions of the glazed elements refer to the drawings provided by the test sponsor.

The glazed elements were comprised of nominal 25 mm (t) interlayered glass pane. The glass pane was lined by ceramic fibre and clamped by 1 mm (t) galvanized mild steel (GMS) angles. The stainless steel angles were fixed onto the door leaf by ø4 x 25 mm wood screw. On top of that was 25 mm (width, parallel to the glass) x 14.5 mm (thick, perpendicular to the glass) chamfered glazing beads with bolection return. The glazing beads were fixed onto the door leaf by wood nails at approximate 200 mm centre to centre.

The edges of the glass panes were caulked with fire sealant.

3.1.4 Overhead Panel

The specimen comprised of an overhead panel. The overhead panel was sized 2698 mm (w) x 550 mm (h).

The framework of the overhead panel was made of 3 numbers of 45 mm (w) x 38 mm (t) wooden slabs. The core of the overhead panel was filled with 38 mm (t) perlite board.

The overhead panel was fixed to the framework by ø5 x 75 mm wood screws at approximate 250 mm centre to centre.

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3.1.5 Side Glazed Panel

The specimen comprised of a glazed side panel visually sized 325 mm (w) x 2270 mm (h).

The glazed elements were comprised of nominal 25 mm (t) interlayered glass pane. 1 mm (t) stainless steel angle was pre-fixed onto the framework at the aperture rebate. The glass pane was lined by ceramic fibre and pushed to the aperture rebate by another angle. The stainless steel angles were fixed onto the framework by ø4 x 25 mm wood screws. On top of that 20 mm (width, parallel to the glass) x 28 mm (thick, perpendicular to the glass) rounded glazing beads were fixed onto the framework by wood nails at approximate 200 mm centre to centre.

3.1.6 Ironmongeries

The active leaf was supported into the door frame by 4 numbers of butt hinge. The inactive leaf was supported into the door frame by 4 numbers of spring hinges. The top and bottom hinges were installed approximate 150 mm away edges.

1 number of mortised lock with lever handle was installed at 1000 mm above the bottom edge of the active leaf.

2 numbers of door closer was regular arm surface mounted at the top rim of each door leaf approximate 250 mm away from the hinge edge on the pull side.

1 number of flush bolt was installed at the top of meeting edge on the inactive leaf.

1 number of barrel bolt was installed at the bottom edge near the meeting edge on the push side of inactive leaf.

1 number of conceal bottom active drop seal was installed at the bottom edge on inactive leaf.

Fire sealant was applied to the mortised area of ironmongeries.

The door lock was LATCHED and both of the flush bolted and barrel bolted were BOLTED during the test.

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3.2 Material Schedule

Parts specifications of specimen were summarized in the following tables.

A star mark "*" indicates those not being verified by FORTE.

Door Frame

Manufacturer:	Leung's Wooden Co. Ltd.	
Materials:	Hardwood	
Density:	550 - 700 kg/m^{3*}	
Overall Sizes:	2764 mm by 2961mm	
Dimensions:	Perimeter Frame	50 mm by 100mm
	Transom	70 mm by 100mm
Rebate:	20 mm	
Connection Method of Head to Jamb:	Mitred Joint with Groove and Tongue; Fixed by wooden screws.	
Connection Method of Transom to Jamb:	Mortise and Tenon fixed by wood screws.	
Fixing Method to Sub-frame:	Wood screws and metal pins	
Gap Filling between Door Frame and Sub-frame:	Fire sealant	

Door Sub-frame

Manufacturer:	Leung's Wooden Co. Ltd.
Material:	Film Plywood
Density:	350 kg/m^{3*}
Sizes:	18 mm by 100mm
Fixing Method to Concrete Sub-frame:	Screws with plastic plug

Architraves

Manufacturer:	Leung's Wooden Co. Ltd.
Material:	Hardwood
Density of hardwood:	550 - 700 kg/m^3
Overall Sizes:	45 mm by 12 mm

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Door Leaves

Manufacturer:		Leung's Wooden Co. Ltd.
Sizes		(1100 mm +1200 mm) by 2338 mm by 50 mm
Stiles and Rails	Material:	Wooden Slabs
	Width:	45 mm
	Thickness:	38 mm
	Density:	350 - 450 kg/m^{3*}
	Moisture Content:	12 - 17%
Core	Supplier:	Leung's Wooden Co. Ltd.
	Material:	Perlite
	Thickness:	38 mm
	Density:	380 kg/m^{3*}

Door Leaf Lippings

Manufacturer:	Leung's Wooden Co. Ltd.
Material:	Hardwood
Density:	550 - 700 kg/m^{3*}
Thickness:	8 mm

Door Leaf Facings

Manufacturer:	Leung's Wooden Co. Ltd.
Material:	Medium Density Fiberboard
Density:	350 - 450 kg/m^{3*}
Thickness:	3 mm

Door Leaf Sub-facings

Supplier:	Leung's Wooden Co. Ltd.
Brand:	Gemtree
Description	Fire rated board
Density:	950 ± 100 kg/m^{3*}
Thickness:	3 mm

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Glazed Element – Glass Pane

Supplier:	Leung's Wooden Co. Ltd.	
Brand - Model:	Hengbao	
Nominal Thickness:	25 mm	
Full Sizes:	Pane 1	775 mm by 225 mm
	Pane 2	325 mm by 325 mm
	Pane 3	275 mm by 1625 mm
Visual Sizes:	Pane 1	725 mm by 175 mm
	Pane 2	275 mm by 275 mm
	Pane 3	225 mm by 1575 mm
Fixing Method:	Lined by mineral wool, clamped by stainless steel angles and wooden glazing beads on both side.	

Glazed Element – Fixing Angles

Supplier:	Leung's Wooden Co. Ltd.
Material:	Stainless steel
Thickness:	1 mm

Glazed Element – Mineral Wool

Supplier:	Garish Crown Fire Engineering & Consultancy
Material:	Fire Resistant wool (ceramic fibre tape)
Density:	100 kg/m^{3*}
Locations of Application:	Glass pane liner

Glazed Element – Glazing Beads

Manufacturer:	Leung's Wooden Co. Ltd.
Material:	Hardwood
Density:	550 - 700 kg/m^{3*}
Sizes:	25 mm by 14.5 mm
Fixing Method:	Wood nails at approximate 200 mm centre to centre

Butt Hinges

Supplier:	Leung's Wooden Co. Ltd.
Brand:	VALANCE
Model:	3044-2BB-ST
Sizes:	102 mm by 102 mm by 3 mm

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Spring Hinges

Supplier:	Tung Fat Ho Building Material Ltd.
Brand:	VALANCE
Model:	PH-102-ST-AW
Sizes:	100 mm by 100 mm by 3 mm

Door Closers

Supplier:	Tung Fat Ho Building Material Ltd.
Brand:	VALANCE
Model:	D-1504-BS-SV / D355c-DA-BS-SV

Flush Bolts

Supplier:	Tung Fat Ho Building Material Ltd.
Brand:	VALANCE
Model:	FB-152-ST
Sizes:	150 mm

Door Lock

Supplier:	Leung's Wooden Co. Ltd.
Brand:	VALANCE
Model:	CSI-B/S60-ST/BE-LV008-38/CYESOI/VAL-6PC-ESCY01-L70-SNP
Sizes:	164 mm by 105 mm by 25 mm

Push Plate

Supplier:	Leung's Wooden Co. Ltd.
Material:	Stainless Steel
Thickness:	1 mm
Sizes:	100 mm by 220 mm

Kicking Plate

Supplier:	Leung's Wooden Co. Ltd.
Material:	Stainless Steel
Thickness:	1.5 mm
Sizes:	1100 mm by 800 mm

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Door Selector

Supplier:	Leung's Wooden Co. Ltd.
Brand:	VALANCE
Model:	DS-400-ST

Conceal Bottom Smoke Seal

Supplier:	Garish Crown Fire Engineering & Consultancy
Brand:	Raven
Model:	RP8si / RP308Si (replacement)

Rebate Corner Smoke Seal

Supplier:	Garish Crown Fire Engineering & Consultancy
Brand:	Raven
Model:	RP120
Material:	12 mm x 12 mm
Locations of Application:	Rebate Corner

Intumescent Material – Door Edges

Supplier:	Leung's Wooden Co. Ltd.	
Brand:	Lorient	
Model:	LP 3004 / LP 1004 / LP 1004	
Size:	Door Frame	20 mm by 4 mm and 10 mm by 4 mm
	Door Meeting edge	20 mm by 4 mm and 10 mm by 4 mm
	Framework around Panels	30mm by 4 mm

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Fixing – Door Frame

Supplier:	Leung's Wooden Co. Ltd.
Brand:	Howin - HMF
Size:	10 mm by 112 mm screws with metal plug

Fire Sealant

Supplier:	Hilti
Brand:	Hilti
Model:	CP606
Locations of Application:	Gap between the door frame and sub-frame

Glue

Supplier:	Leung's Wooden Co. Ltd.
Brand:	Not provided
Type:	木膠粉

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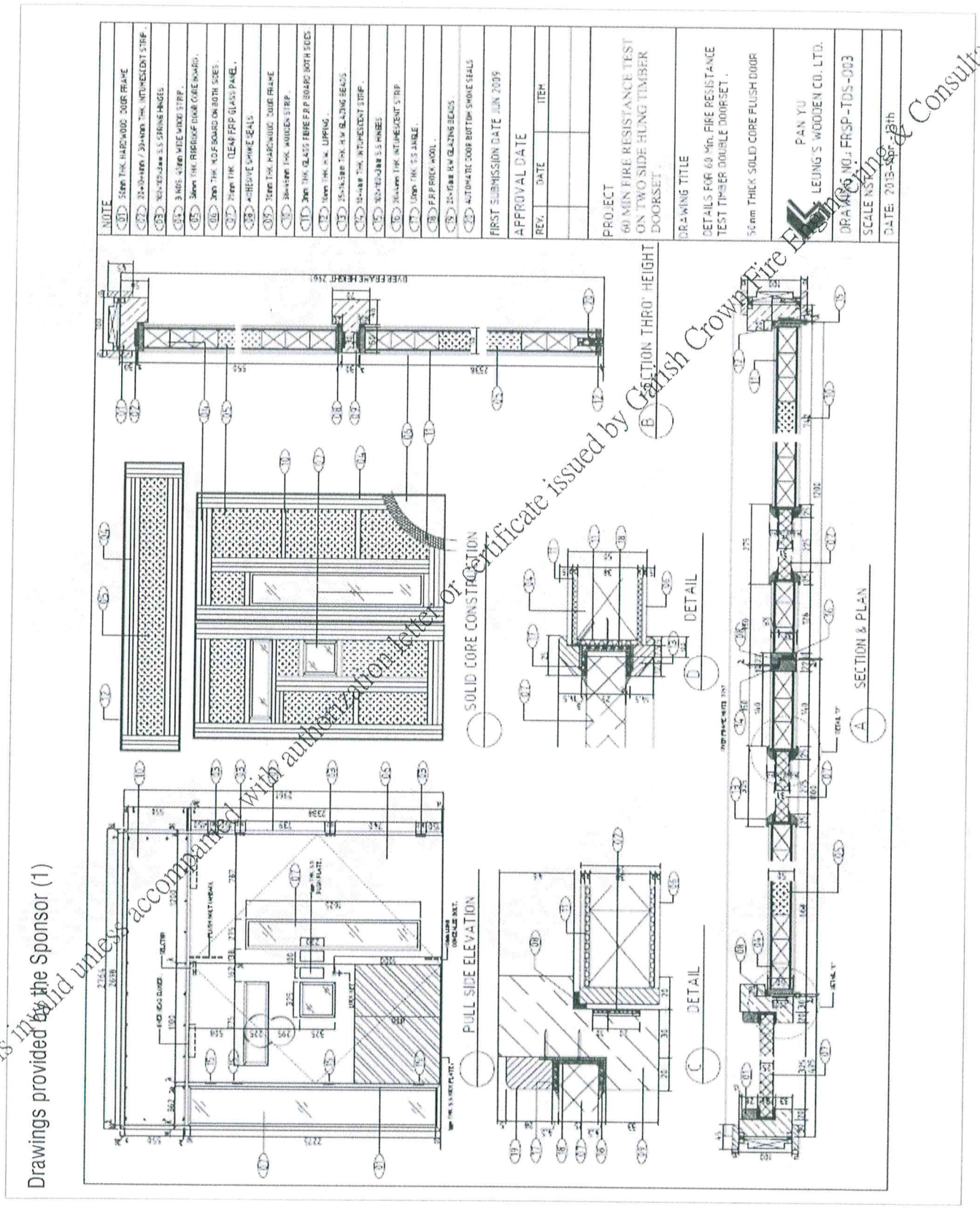
3.3 Drawings on Specimen provided by the Sponsor (Total 1 Page)



Drawings provided by the Sponsor (1)

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4. Specimen Condition

4.1 Selection of the Specimen

The specimen was selected by the Sponsor and submitted to the Test Location. FORTE did not involve in the selection of the specimen.

All the components of the test specimen were supplied by the Sponsor.

4.2 Verification of the Specimen

Samples of components of the specimen were prepared by the Sponsor.

In *section 3.2* of this report, items which had been verified by FORTE was clearly identified and distinguished from those relying on Sponsor's declaration.

4.3 Supporting Construction

The specimen was fixed into a supporting construction made of fully cured reinforced normal density concrete slabs provided by FORTE. The concrete slabs formed a structural opening 2810 mm (w) x 2990 mm (h) for the specimen.

4.4 Installation of the Specimen

The specimen was assembled and installed by workers delegated by the Sponsor on 2013-04-23

4.5 Specimen Conditioning

The specimen was stored in the Test Location from 2013-04-23, the date which specimen was received, to 2013-04-26 the date which fire resistance test performed.

The average environment parameters in the Test Location within this period were:

Ambient Temperature (°C)	Relative Humidity (%)
22 ± 5	77 ± 10

4.6 Direction of Fire Side and Others

The Sponsor has designated and installed the specimen that door leaves could only be swung inwards the furnace.

With reference to *Clause 13; BS EN 1634-1: 2008*, hinged timber leaf timber frame doors tested opening into the furnace may cover the opposite direction on both integrity and insulation criteria.

The door lock was LATCHED and both of the flush bolted and barrel bolted were BOLTED during the test.

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5. Test Method

5.1 Pre-test Conditioning

The pre-test conditionings of the specimen were carried out on 2013-04-26 prior to the fire test with reference to *BS EN 1634-1: 2008* and *clause 5.1, BS EN 14600: 2005*.

5.2 Ambient Temperature

The ambient temperature was measured by mineral insulated metal sheathed type K thermocouple. The measuring junction was screened by two concentric plastic pipes from radiated heat and draught, at a position approximate 1500 mm away the test construction.

5.3 Heating Condition

The average temperature inside the furnace was monitored and controlled throughout the test according to the standard heating curve stated in *BS EN 1363-1:1999* given by the equation:

$$T = 345 \log_{10}(8t+1) + 20$$

Where,

T is the average furnace temperature, in degree Celsius

t is the time, in minutes

The temperature inside the furnace was measured in conformity with *BS EN 1363-1: 1999* by 9 numbers of plate thermometers. These thermometers were evenly distributed over a vertical plane approximately 100 mm from the exposed surface of the test construction.

The positions of furnace thermocouples are shown in *Figure 1*.

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5.4 Unexposed Surface Temperature

The unexposed surface temperatures of the specimen were measured by 62 numbers of type K thermocouples.

The temperature rise was calculated by subtracting the initial average temperature from the unexposed surface temperature measured.

The specimen was evaluated against the maximum temperature rise criterion given by supplementary procedure – Classification I_1 at the request of the Sponsor.

These thermocouples were positioned and fixed on unexposed surface of the test specimen in conformity with *BS EN 1634-1: 2008*.

The positions of unexposed surface temperature measurement points are shown in *Figure 3*. The locations of thermocouples are explained in the following table.

Thermocouple	Area	Description
U1 – U5	Door Leaves	For average and maximum unexposed surface temperature rise
U6 – U15; U43 – U52	Door Leaves	For maximum unexposed surface temperature rise **(Supplementary Procedure, I_1)**
U16 – U23	Framework	For maximum unexposed surface temperature rise
U24 – U26; U28 – U31	Glazed Elements on door leaves	For average and maximum unexposed surface temperature rise
U27; U32 – U35	Glazed Side Panel	For average and maximum unexposed surface temperature rise
U59 – U62	Glazed Side Panel	For maximum unexposed surface temperature rise **(Supplementary Procedure, I_1)**
U36 – U42	Overhead Panel	For average and maximum unexposed surface temperature rise
U53 – U58	Overhead Panel	For maximum unexposed surface temperature rise **(Supplementary Procedure, I_1)**

5.5 Pressure Condition

The pressure inside the furnace was continuously monitored in compliance with *BS EN 1363-1: 1999* during the whole test. The pressure at a point 500 mm above the notional floor level was to be maintained 0 ±5 Pa by five minutes from commencement of the test and 0 ±3 Pa that from ten minutes onwards with respect to the atmosphere.

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5.6 Deflection Measurements

Measurements of the deflection of the test specimen were taken with a steel rule from cross line laser across the top, mid-height and bottom of the specimen.

The positions of deflection measurement points are shown in *Figure 3*.

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Figure 1. Position of thermocouples and pressure measuring probe inside the furnace.

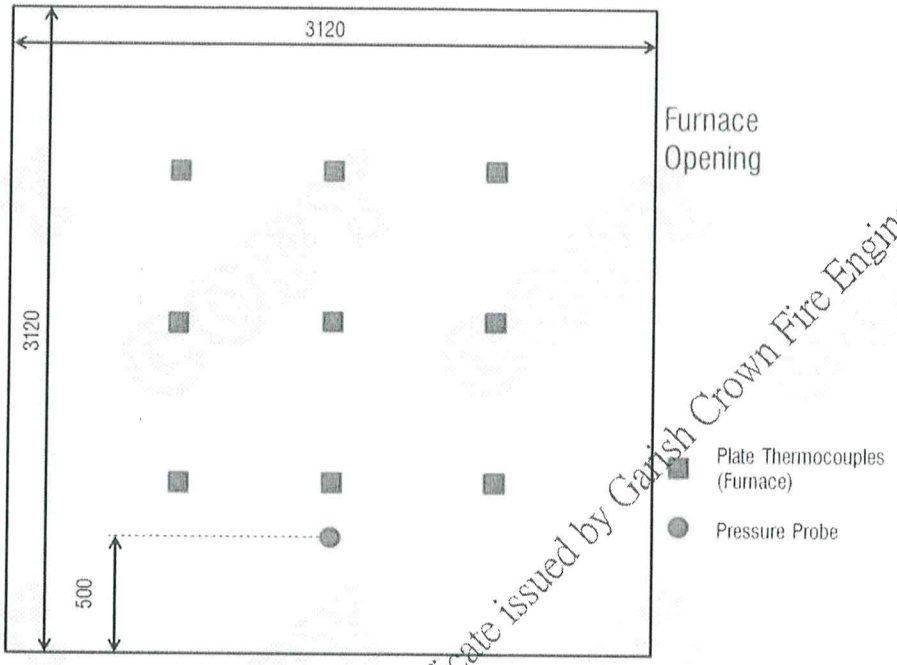

Figure 2. Primary gaps measurement positions.

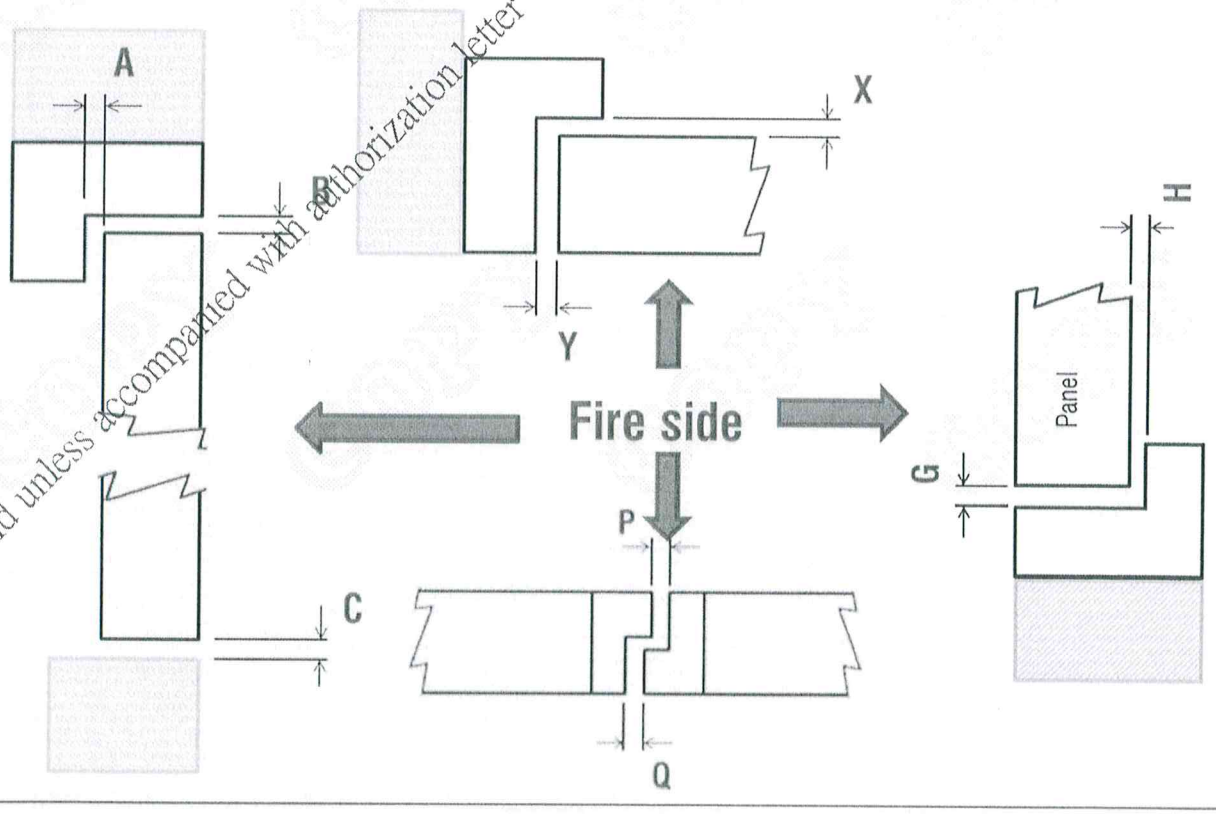

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Figure 3a. Positions of fixed surface and roving thermocouples (U) on specimen.

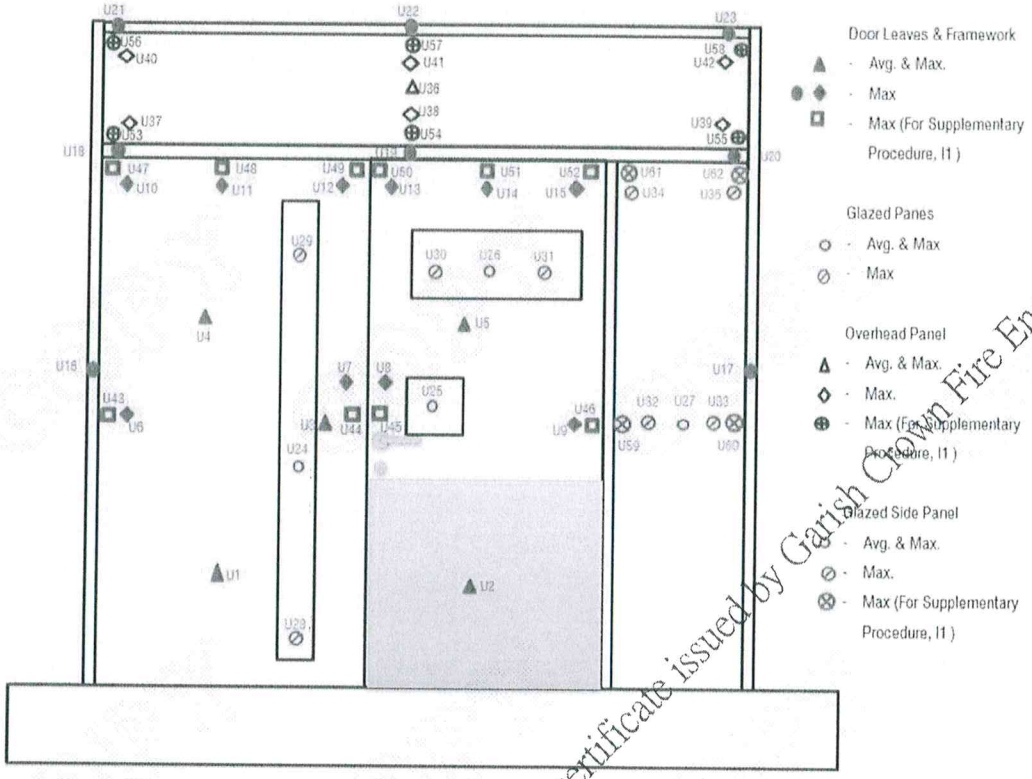
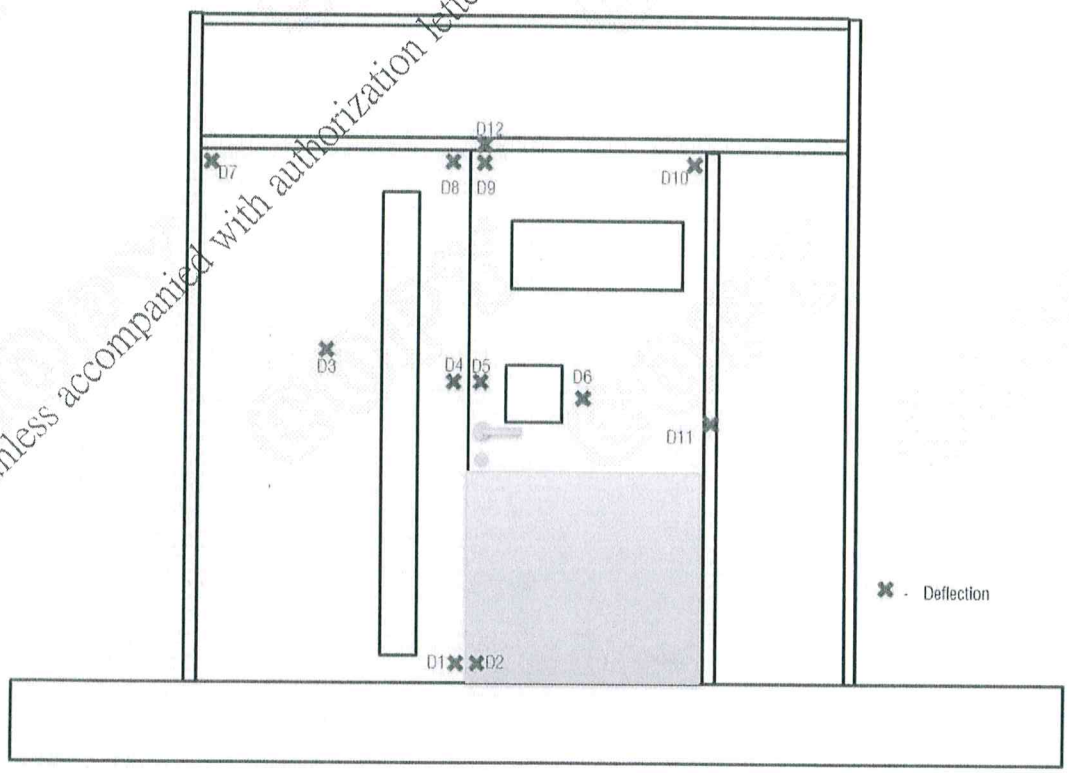


Figure 3b. Positions of deflection measuring points (D) on specimen.



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6. Test Data

6.1 Retention Forces

The retention forces on each door leaf of the specimen for each direction of opening were determined. The respective highest gauge measurements are summarized in the following table.

Leaf	Push	Pull
Active	95.1 N	89.5 N
Inactive	86 N	102.8 N

6.2 Gaps Measurement

Primary gaps of the specimen were measured and subsequently processed in accordance with *BS EN 1634-1: 2008* and summarized in the following table.

"*N.A.*" stands for **n**ot **a**pplicable. Measurements were taken in mm.

Gap	Measured		
	Minimum	Maximum	Average
A	1.3	3.0	2.4
B	1.2	3.0	2.1
C	1.5	9.0	4.2
X	1.4	4.5	2.3
Y	1.9	4.2	2.8
G	0.5	2.7	1.8
H	1.5	3.5	2.2
P	1.0	2.5	1.5
Q	0.5	1.6	0.95

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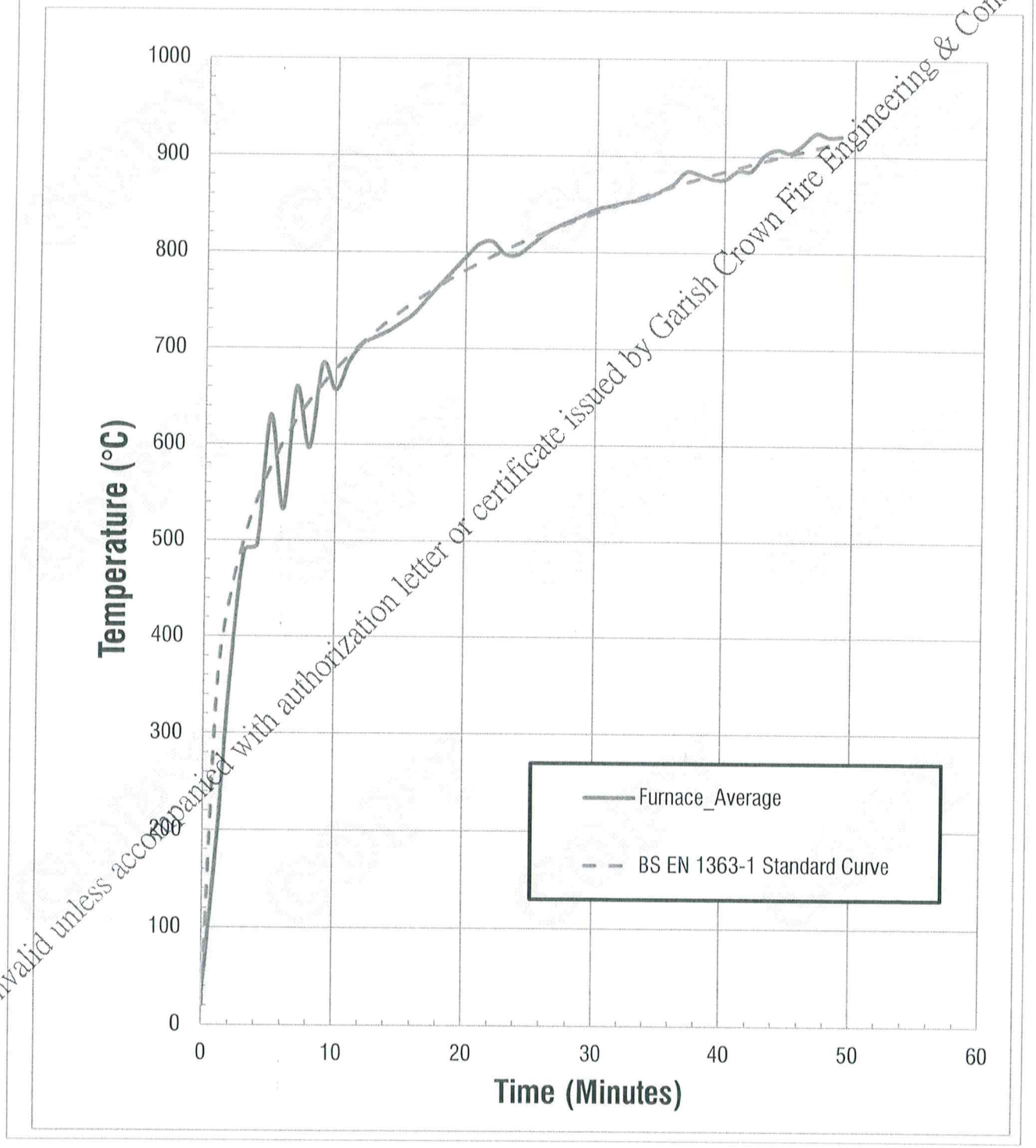
6.3 Furnace Temperature

The furnace average temperature over the test period is shown in *Figure 4*.

Figure 4. Furnace average temperature over the test period.



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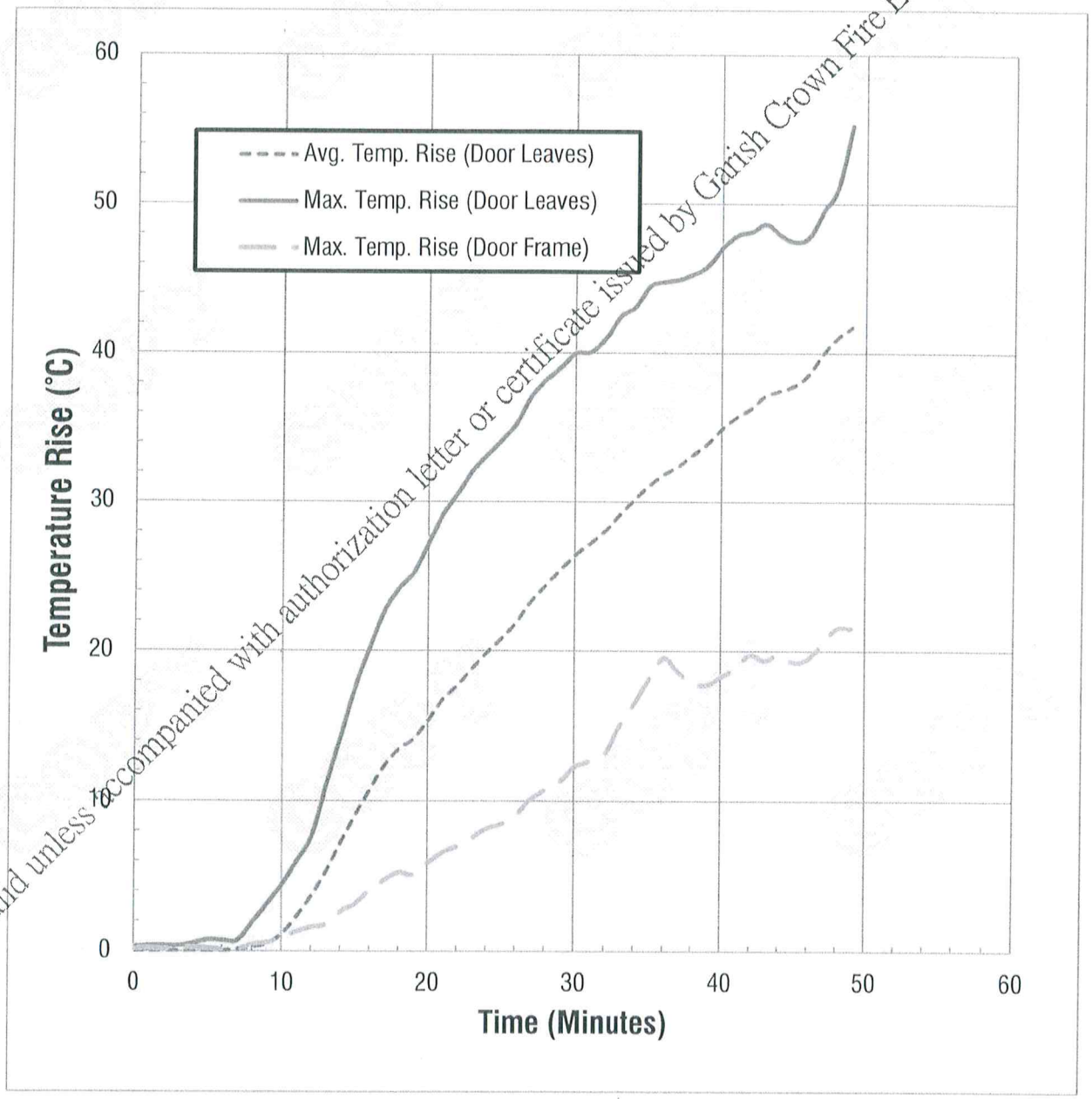
6.4 Unexposed Surface Temperature Rise

6.4.1 Specimen

6.4.1.1 Fixed surface thermocouples – Door Leaves and Framework

The temperature rises of unexposed surface of door leaves and door frame measured by fixed surface thermocouples over the test period are shown in *Figure 5*.

Figure 5. Average and maximum temperature rise on door leaves and framework of specimen over the test period.



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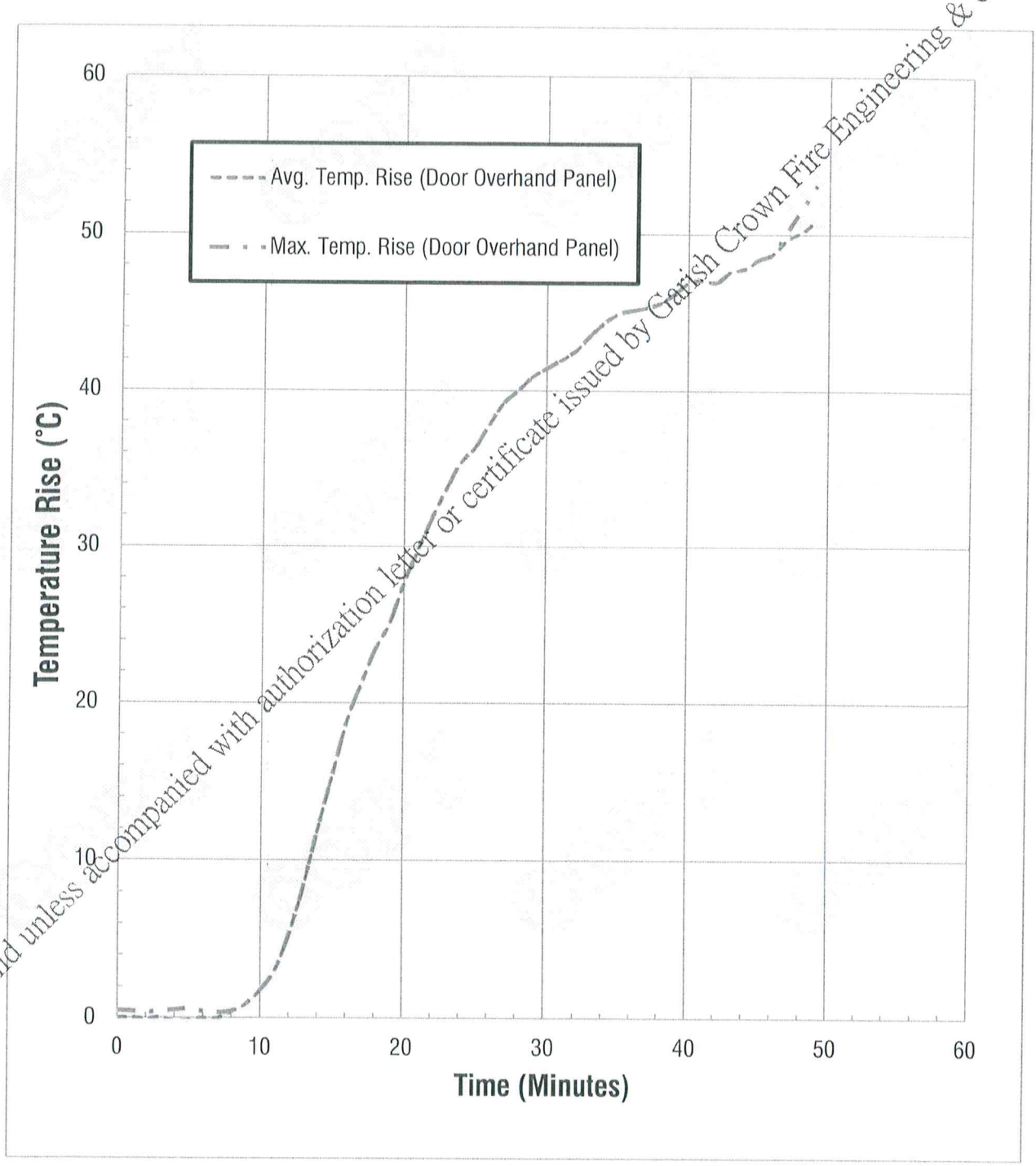
6.4.1.2 Fixed surface thermocouples – Overhead Panel

The temperature rises of unexposed surface of the overhead panel is measured by fixed surface thermocouples over the test period are shown in *Figure 6*.

Figure 6. Average and maximum temperature rise on overhand panel on specimen over the test period.



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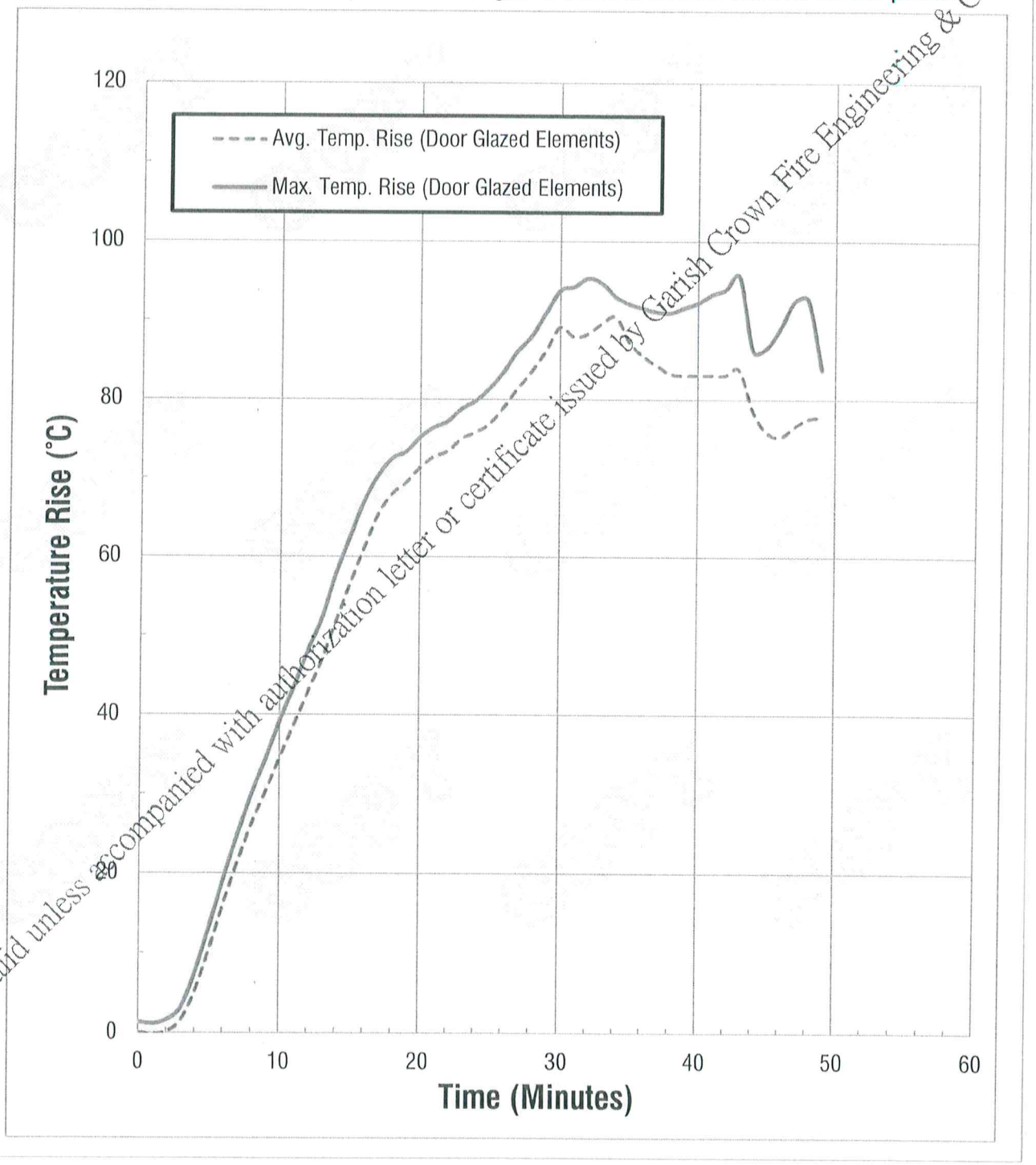
6.4.1.3 Fixed surface thermocouples – Glazed Elements

The temperature rises of unexposed surface of the glazed elements on door leaf are measured by fixed surface thermocouples over the test period are shown in *Figure 7*.

Figure 7. Average and maximum temperature rise of glazed elements on Door leaf over the test period.



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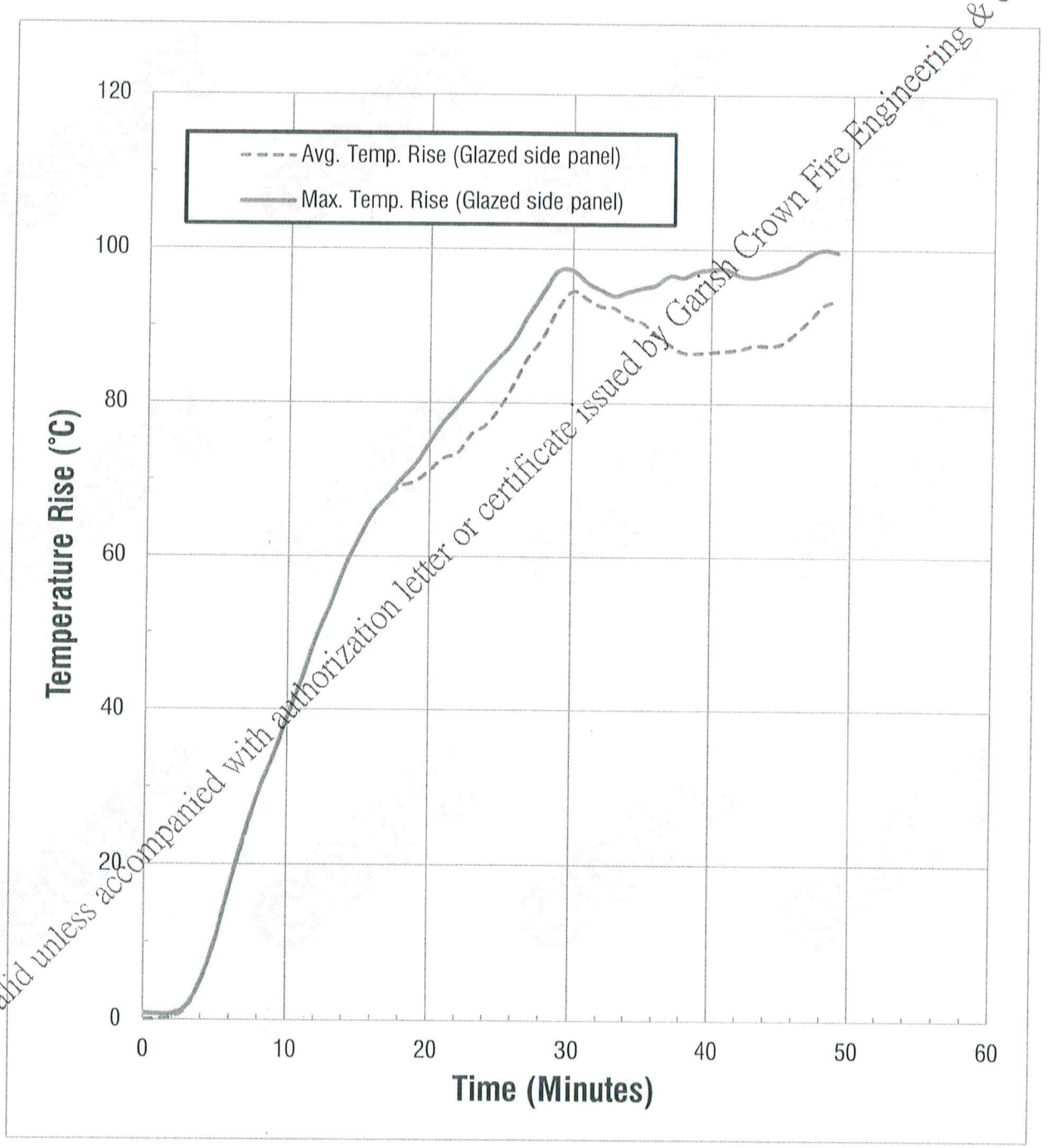
6.4.1.4 Fixed surface thermocouples – Glazed Side Panel

The temperature rises of unexposed surface of the glazed side panel is measured by fixed surface thermocouples over the test period are shown in *Figure 8*.

Figure 8. Average and maximum temperature rise on glazed side panel on Door over the test period.



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6.4.2 Fixed surface thermocouples – Detailed Temperature Records

The outputs of the unexposed surface thermocouples on specimen are summarized in the following tables.

Measurements were taken in °C.

Temperature outputs from unexposed surface temperature U1 to U20

Time (min)	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10
0	21.3	20.8	21.1	21.3	21.5	21.2	20.7	19.8	20.9	20.9
5	21.2	20.7	21.2	21.5	21.7	21.3	20.7	19.8	20.9	20.8
10	23.7	20.8	21.9	23.8	21.8	21.3	20.9	20.2	21.0	21.5
15	38.9	21.7	23.2	38.1	29.6	23.1	21.6	20.6	23.3	23.9
20	48.4	25.6	25.0	48.5	35.6	26.9	23.6	22.6	27.3	26.3
25	55.3	31.5	28.0	55.4	40.1	31.4	26.9	25.3	31.3	29.2
30	61.2	38.7	33.3	60.2	44.9	37.3	32.5	30.0	35.9	33.1
35	65.8	43.5	39.0	63.5	50.2	43.3	39.0	35.5	41.3	37.5
40	68.3	47.3	45.5	64.5	55.2	49.8	46.6	41.7	47.0	42.4
44	69.2	49.7	51.8	65.2	57.8	55.1	53.6	47.3	49.8	46.8
45	68.7	50.3	53.0	65.2	58.2	55.9	55.0	48.5	50.1	47.5
46	69.1	51.0	54.6	65.4	59.1	57.3	57.0	49.9	51.1	48.5
47	70.8	52.0	56.6	66.4	60.5	59.0	59.0	51.8	52.4	50.0
48	72.0	52.9	58.0	67.1	61.5	60.5	61.1	53.5	54.1	51.0
49	72.0	53.7	59.8	67.5	62.0	61.8	62.9	55.1	54.6	52.5

Time (min)	U11	U12	U13	U14	U15	U16	U17	U18	U19	U20
0	20.9	21.1	21.4	20.8	20.3	19.5	20.5	21.2	20.7	20.9
5	20.9	21.1	21.4	20.7	20.3	19.5	20.6	21.1	20.8	20.9
10	25.7	21.1	21.7	20.8	20.6	19.3	21.7	21.3	20.8	22.2
15	30.5	21.9	23.0	26.9	22.1	19.7	23.2	22.4	21.5	24.4
20	33.4	23.9	25.6	33.2	23.8	20.7	25.1	23.2	22.4	27.1
25	36.4	27.2	29.0	37.5	26.2	21.4	27.3	23.8	23.1	29.7
30	40.3	32.1	32.9	42.9	29.4	22.1	30.4	25.4	24.6	33.5
35	44.6	38.3	37.5	46.7	33.4	22.7	34.0	26.4	26.0	39.3
40	48.3	45.1	43.0	50.1	37.9	23.3	36.5	27.4	27.4	39.5
44	52.0	50.1	47.9	53.1	40.9	24.0	38.6	28.4	28.0	41.0
45	52.6	51.3	49.1	53.7	41.6	23.9	38.6	28.4	28.2	40.5
46	53.4	52.9	50.4	54.8	42.6	24.0	38.8	28.8	28.5	40.7
47	54.6	55.3	52.3	56.6	43.8	24.2	40.1	29.5	29.3	41.7
48	55.7	57.0	53.5	57.3	45.3	24.6	41.0	29.8	29.2	42.7
49	56.7	58.6	54.7	58.0	46.7	24.7	41.4	30.2	29.7	42.8

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Temperature outputs from unexposed surface temperature U21-U40

Time (min)	U21	U22	U23	U24	U25	U26	U27	U28	U29	U30
0	21.4	20.3	19.9	19.3	20.8	20.7	20.8	21.2	21.6	20.7
5	21.4	20.2	20.0	30.7	31.7	29.3	31.2	30.3	33.4	30.6
10	21.5	20.2	20.1	56.0	56.8	51.8	60.0	57.5	59.6	55.9
15	22.0	20.7	20.8	78.6	80.5	71.9	83.3	79.7	83.0	76.6
20	22.9	21.3	21.7	93.6	93.7	87.9	92.1	95.2	95.6	91.8
25	23.6	21.9	22.4	98.7	98.8	94.1	100.3	100.1	101.7	95.4
30	25.6	23.4	23.9	113.2	114.1	101.1	115.4	113.1	112.2	102.1
35	27.5	24.2	26.6	24.6	112.4	102.9	111.3	111.4	103.4	99.0
40	29.0	25.1	27.5	22.1	112.6	94.3	107.6	104.4	102.1	31.5
44	30.7	25.8	28.2	21.1	106.5	91.3	108.4	96.4	106.0	26.4
45	30.9	25.5	28.0	20.8	102.2	90.3	108.7	95.2	106.9	25.4
46	31.4	25.6	27.9	20.6	100.8	90.4	110.1	94.6	109.5	25.0
47	32.3	26.1	28.9	20.8	102.7	91.1	111.8	96.1	112.8	25.4
48	33.4	26.5	29.5	21.0	103.8	92.0	113.7	95.9	113.0	25.4
49	33.8	26.8	29.7	20.9	104.1	92.2	114.2	61.6	79.0	25.3

Time (min)	U31	U32	U33	U34	U35	U36	U37	U38	U39	U40
0	20.1	19.8	20.9	20.7	21.4	21.0	21.5	20.6	19.8	19.4
5	26.7	30.2	31.3	30.0	31.3	20.9	21.6	20.6	20.0	19.4
10	46.9	57.7	58.2	54.9	59.1	22.8	22.0	20.7	20.5	19.6
15	62.1	79.0	80.3	75.8	82.6	36.4	23.0	22.2	22.4	21.4
20	78.1	88.7	92.6	86.6	91.9	48.7	24.7	25.0	24.3	23.3
25	83.5	94.9	101.5	95.6	99.5	57.3	27.2	28.8	26.8	25.9
30	91.1	108.0	116.6	106.6	108.4	62.4	31.6	34.4	30.6	29.7
35	101.5	106.9	64.3	108.5	106.9	65.9	36.1	39.8	36.5	34.2
40	102.6	104.1	52.9	105.2	104.7	67.9	41.5	46.0	41.6	38.9
44	37.5	102.8	44.9	104.3	105.0	68.8	46.6	50.9	44.6	43.5
45	30.0	99.9	42.2	104.9	105.7	69.4	47.9	52.3	45.7	44.7
46	26.9	100.6	41.1	105.7	106.8	69.8	49.4	53.4	46.8	45.6
47	26.4	102.7	43.3	106.7	108.3	70.7	51.7	55.1	48.3	46.9
48	25.8	104.6	45.8	107.6	109.4	71.2	52.7	56.4	48.7	48.1
49	25.1	106.1	43.4	109.0	110.9	71.9	54.7	58.1	49.6	49.3

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Temperature outputs from unexposed surface temperature U41-U60

Time (min)	U41	U42	U43	U44	U45	U46	U47	U48	U49	U50
0	21.3	21.3	21.3	20.7	21.4	20.8	20.3	20.3	20.9	20.5
5	21.2	21.2	21.3	20.7	21.4	20.7	20.7	20.2	21.2	22.0
10	21.8	21.5	21.3	21.9	21.7	20.8	22.2	20.7	21.3	22.0
15	25.6	22.9	22.1	24.5	22.7	21.1	24.5	22.1	23.6	23.9
20	30.8	25.0	24.0	24.1	23.9	22.6	28.8	24.4	27.9	27.3
25	36.7	27.8	27.4	26.7	26.3	25.2	32.5	28.5	31.3	31.6
30	43.7	32.2	32.2	33.6	30.5	29.2	38.2	34.3	36.0	37.1
35	49.9	38.1	38.2	35.5	37.2	34.6	45.7	40.7	42.5	43.6
40	55.0	43.7	45.0	37.9	44.2	41.1	52.8	47.4	49.5	53.8
44	58.3	47.6	50.5	39.9	48.0	46.0	57.9	53.5	55.4	58.0
45	59.0	48.6	51.7	41.9	49.4	48.0	58.7	55.0	56.9	59.3
46	60.0	49.8	53.0	43.9	50.8	51.4	60.4	56.9	58.3	61.1
47	61.4	51.4	54.9	47.4	52.9	53.8	62.5	58.9	60.2	64.1
48	62.6	52.6	56.7	46.0	55.3	55.3	64.7	61.1	61.9	65.3
49	63.4	53.5	58.2	48.9	56.6	57.3	65.7	63.2	63.5	66.7

Time (min)	U51	U52	U53	U54	U55	U56	U57	U58	U59	U60
0	20.2	20.9	21.2	18.3	20.4	20.1	20.7	20.7	20.7	21.0
5	20.2	20.8	21.2	18.2	20.4	20.0	20.6	21.0	28.5	30.5
10	20.3	21.3	21.4	17.9	20.8	20.4	20.7	21.3	54.6	57.7
15	21.5	23.1	22.3	17.3	22.5	22.0	21.5	23.1	74.9	81.3
20	23.8	27.2	24.3	39.0	25.6	24.8	23.3	26.1	91.5	95.5
25	26.3	32.4	27.6	26.4	30.5	28.8	26.1	29.9	98.4	106.5
30	31.4	38.9	32.9	31.3	36.4	35.9	31.4	34.9	107.4	118.1
35	36.1	45.2	38.8	36.5	43.0	42.3	36.8	41.2	109.5	115.8
40	41.3	51.7	45.5	42.3	49.5	47.4	42.9	46.6	108.2	118.2
44	46.0	57.5	51.4	47.1	54.0	53.6	48.0	51.5	36.0	117.6
45	46.9	58.9	52.8	48.0	55.4	54.5	48.8	62.6	31.6	118.2
46	48.1	61.1	55.0	49.2	56.7	56.6	50.1	67.9	29.6	119.0
47	50.3	65.9	57.3	50.9	58.0	58.9	52.2	71.3	29.4	120.2
48	51.5	72.4	60.0	51.7	58.6	60.6	53.6	72.7	29.3	120.8
49	52.9	76.5	61.9	53.2	62.1	62.9	55.0	74.1	28.7	120.5

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Temperature outputs from unexposed surface temperature U61-U62

Time (min)	U61	U62
0	21.6	20.8
5	27.4	28.5
10	51.0	55.3
15	70.1	77.4
20	87.6	95.8
25	97.9	106.9
30	105.5	114.6
35	109.0	107.3
40	112.2	103.7
44	110.1	103.5
45	108.9	103.7
46	107.7	104.1
47	106.7	104.7
48	104.5	104.8
49	104.8	105.1

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6.5 Pressure

The pressure differential in furnace at 500 mm above notional floor level over the test period was summarized in the following table.

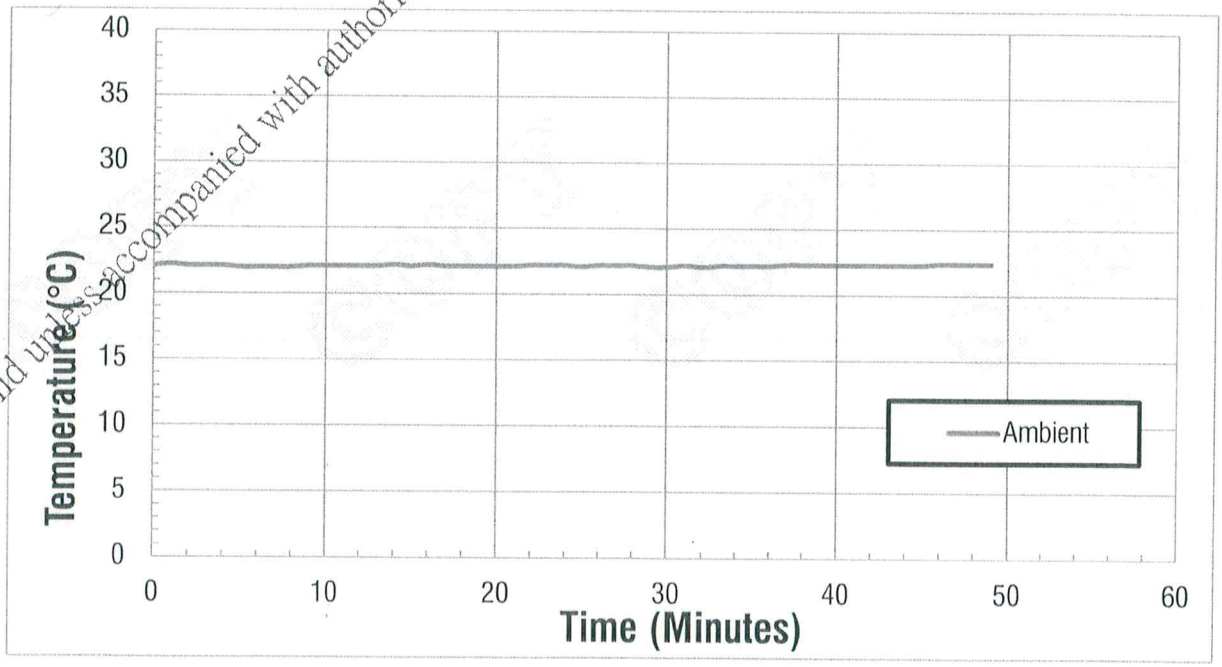
Time (min)	Pressure
0.0	-0.7
6.0	-0.8
10.0	0.3
15.0	-0.5
20.0	-0.8
25.0	0.4
30.0	-0.8
35.0	-1.2
40.0	-0.9
45.0	-1.7
49.0	-1.3

6.6 Ambient Temperature

The ambient temperature over the test period was recorded and shown in *Figure 10*.

The ambient temperature at the commencement of test was 22.1 °C.

Figure 10. Ambient temperature over the test period.



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6.7 Lateral Deflections

Measured lateral deflections of 30 minutes testing duration summarized in the following table. A positive measurement indicates a movement towards into the furnace and vice versa.

Measurements were taken in mm.

Maximum deflection measured on specimen was -14 mm at D6 at 30 minute of test.

Position \ Time (min)	0	10	20	30
D1	+0	-8	-9	-10
D2	+0	-5	3	9
D3	+0	0	-4	-5
D4	+0	-5	-9	-13
D5	+0	-5	-10	-13
D6	+0	-3	10	-14
D7	+0	0	4	7
D8	+0	-2	-3	-4
D9	+0	-4	-2	3
D10	+0	-2	0	2
D11	+0	-4	-6	-6
D12	+0	-1	-4	-6

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6.8 Observations

The table below summarized the observation on the specimen during the test period.
Photos taken during the test period are also attached.

Time (min.sec)	Observation (from unexposed side)
00.00	Test Started.
02.06	The interlayer of the glass panes started to react. The glass panes turned into white color. Smoke released from the top edge of door leaves.
03.21	Smoke released along the perimeter of overhead panel.
04.14	Flaming on the exposed side of the door leaves was observed.
05.14	Smoke further released along the perimeter of the door leaves. Glass panes turned into light brown in color.
06.24	Smoke released from the perimeter of the overhead panel and the top edge of door leaves.
12.28	Unexposed surface of side glass panel and upper glass panel of inactive leaf cracked. Smoke released from the door lock.
16.22	Smoke further released from the door lock.
18.45	More cracks developed on unexposed surface of side glass panel and upper glass panel of inactive leaf.
25.05	The area near the door lock turned dark.
27.12	The bottom edge of the inactive leaf was darkened. Smoke released from glazing bead of the glass panels on inactive leaf.
29.23	Unexposed surface of glass panels on inactive leaf cracked.
30.00	**No integrity failure had occurred.**
31.06	Smoke released from the top glazing beads of upper glass panel on inactive leaf.
31.46	More cracks observed from the side glass panel.
34.16	Intermittent flaming was observed from the bottom of meeting edge.
37.33	Smoke released from meeting edge and cracks on glass panels.
49.15	**Test was terminated at request of the Sponsor.**

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6.9 Photos

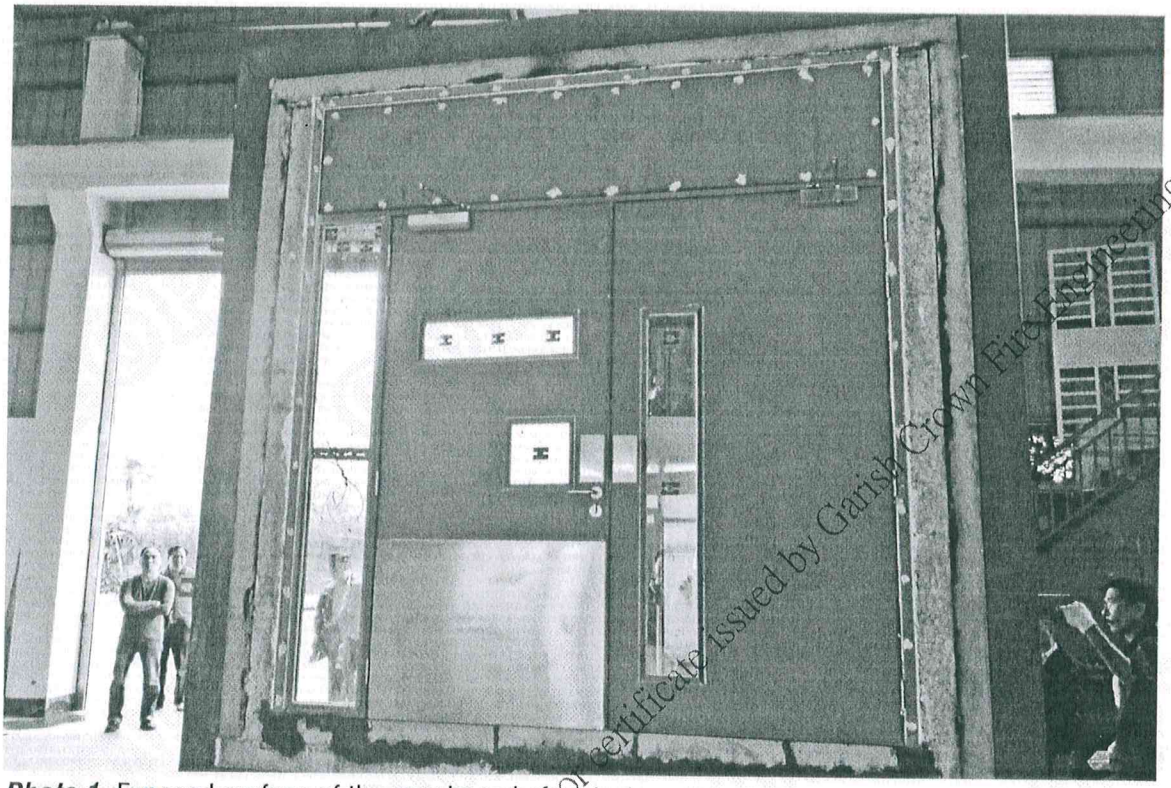

Photo 1. Exposed surface of the specimen before test.

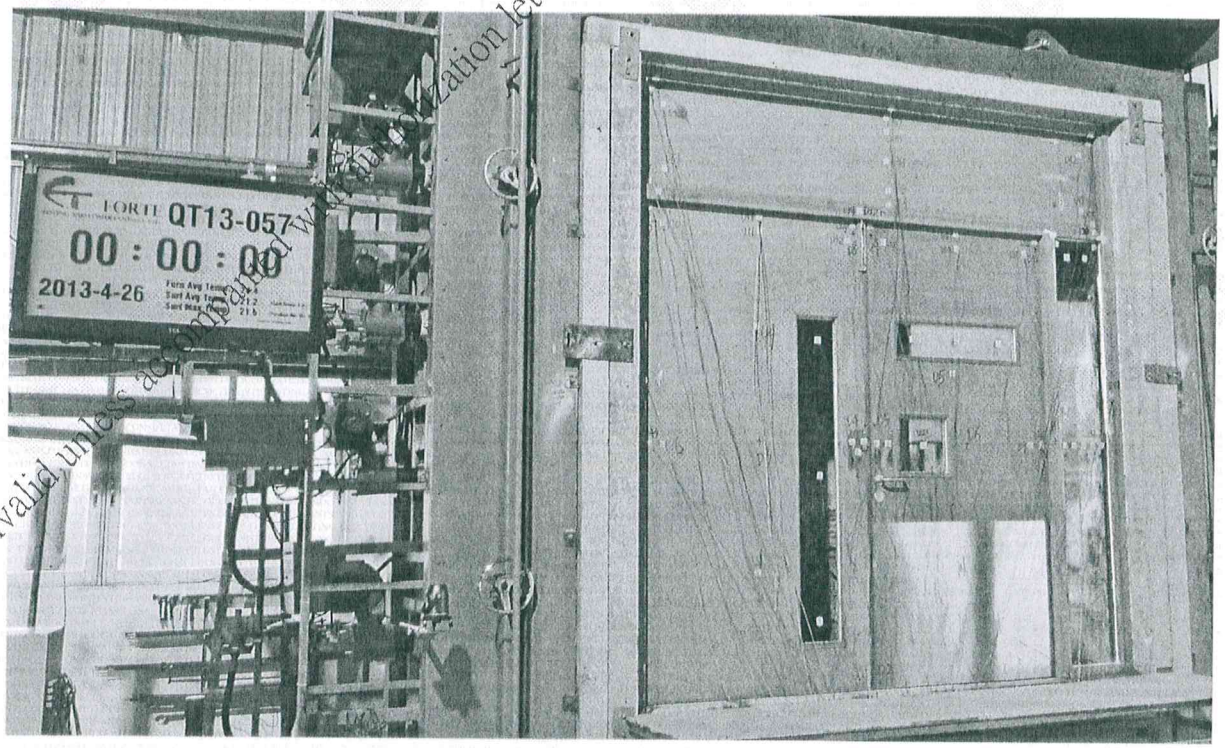

Photo 2. Unexposed surface of the specimen before the commencement of test.

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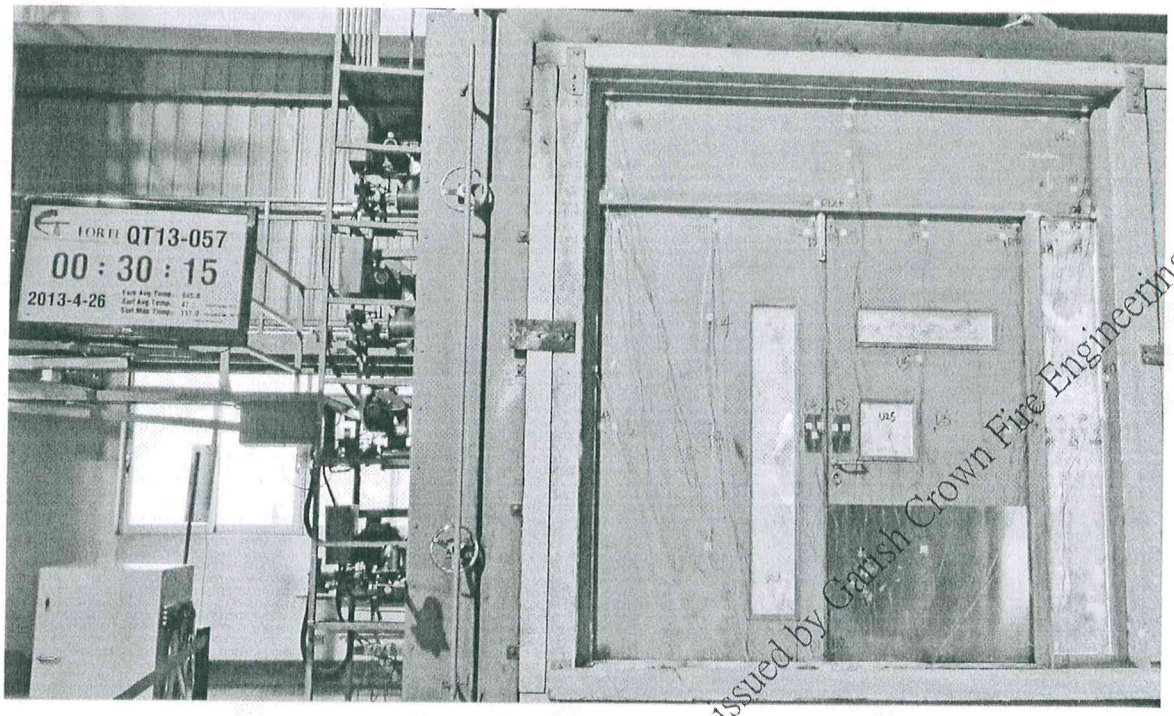

Photo 3. Unexposed surface of the specimen at 30 minute of test.

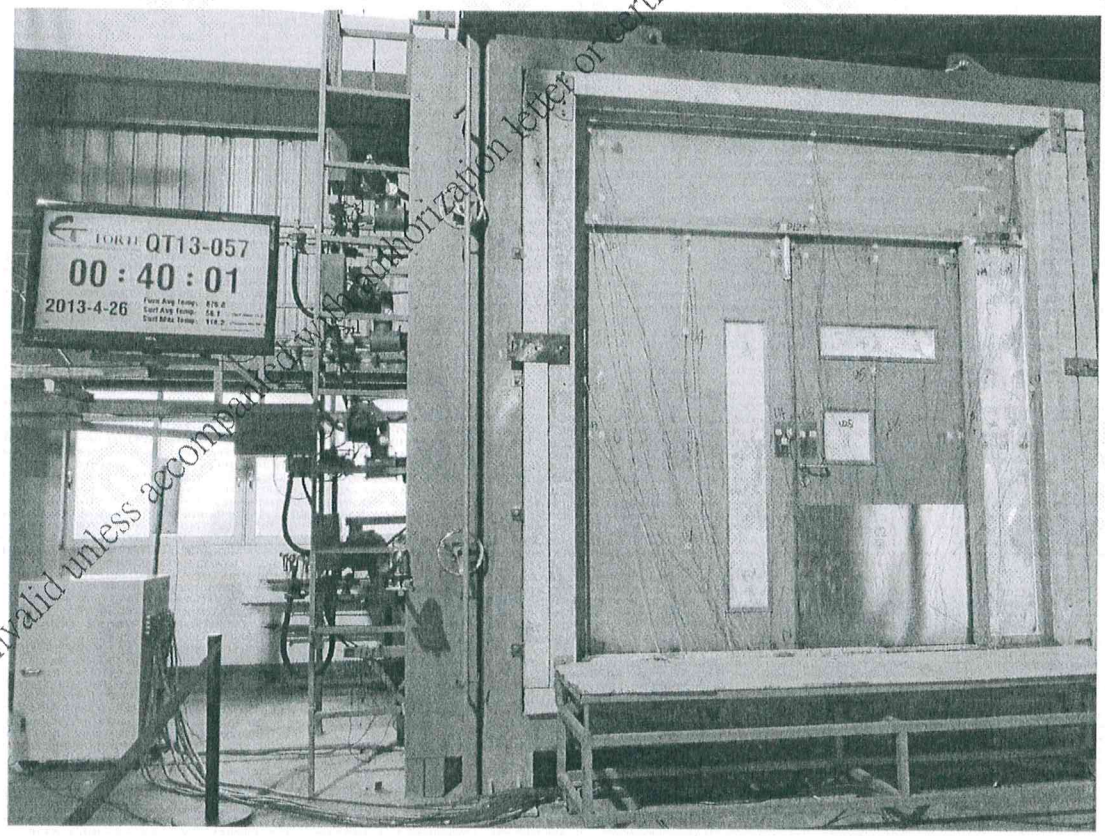

Photo 4. Unexposed surface of the specimen at 40 minute of test.

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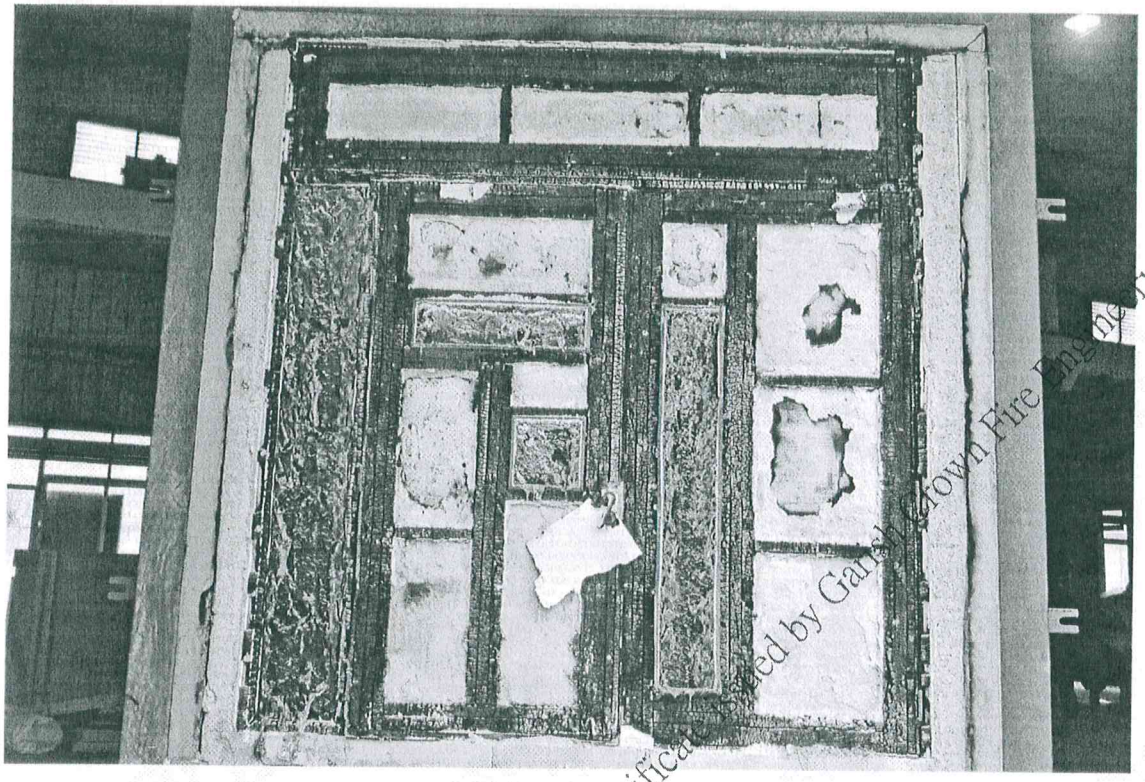

Photo 5. Exposed surface of the specimen after test.

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7. Test Results

The test on specimen was terminated after a test period of 60 minutes at request of the Sponsor.

The test data obtained from the fire resistance test was assessed against performance criteria given in *BS EN 1634-1: 2008*. The test results are summarized in the following table.

Performance Criteria			**Elapsed Time before Failure Occurrence**
Integrity (E)			
Criteria of Failure		**Description**	**Elapsed Time before Failure Occurrence**
Sustained Flaming		Continuous flaming for a period of time greater than 10 seconds on unexposed surface	49 minutes (No Failure)
Gap Gauge	Ø6 mm	Penetration of the gauge into the furnace through the specimen and movable along a 150 mm gap	49 minutes (No Failure)
	Ø25 mm	Penetration of the gauge into the furnace through the specimen	
Cotton Pad		Ignition of the cotton pad	49 minutes (No Failure)

Performance Criteria			**Elapsed Time before Failure Occurrence**	
Insulation (I)				
Criteria of Failure		**Description**	**Elapsed Time before Failure Occurrence**	
Integrity Failure		The performance criterion "insulation" shall automatically be assumed not to be satisfied when the "integrity" criterion ceases to be satisfied	49 minutes (No Failure)	
Average Temperature Rise		An increase of the average temperature of unexposed surface of the specimen above the initial average temperature by more than 140°C	[Door Leaves and Framework]	49 minutes (No Failure)
			[Overhead Panel]	49 minutes (No Failure)
			[Glazed Elements]	49 minutes (No Failure)
			[Glazed Side Panel]	49 minutes (No Failure)
Maximum Temperature Rise **[Supplementary Procedure, I_1]**		An increase of temperature at any other point of the specimen above the initial average temperature by more than 180 °C	[Door Leaves and Framework]	49 minutes (No Failure)
			[Overhead Panel]	49 minutes (No Failure)
			[Glazed Elements]	49 minutes (No Failure)
			[Glazed Side Panel]	49 minutes (No Failure)

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8. Limitations

This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedure outlined in *BS EN 1363-1*, and where appropriate *BS EN 1363-2*. Any significant deviation with respect to size, construction details, loads, stresses, edge or end conditions other than those allowed under the field of direct application in the relevant test method is not covered by this report.

Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result.

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9. Field of Direct Application

The field of direct application defines the allowable changes to the test specimen following a successful fire resistance test. These variations can be introduced automatically without the need for the sponsor to seek additional evaluation, calculation or approval.

The series of rules and guidelines are defined in *Clause 13 "Field of direct application of test results", BS EN 1634-1: 2008* and relevant clauses and annexes. Permitted variations away from the test specimen include 1) materials and construction, 2) size variations, 3) coverage of asymmetrical doorsets and 4) supporting constructions.

The field of direct applications may only be defined following the identification of classification(s). The field of direct and, where applicable, extended application will be included in classification relevant documents.

END OF REPORT

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